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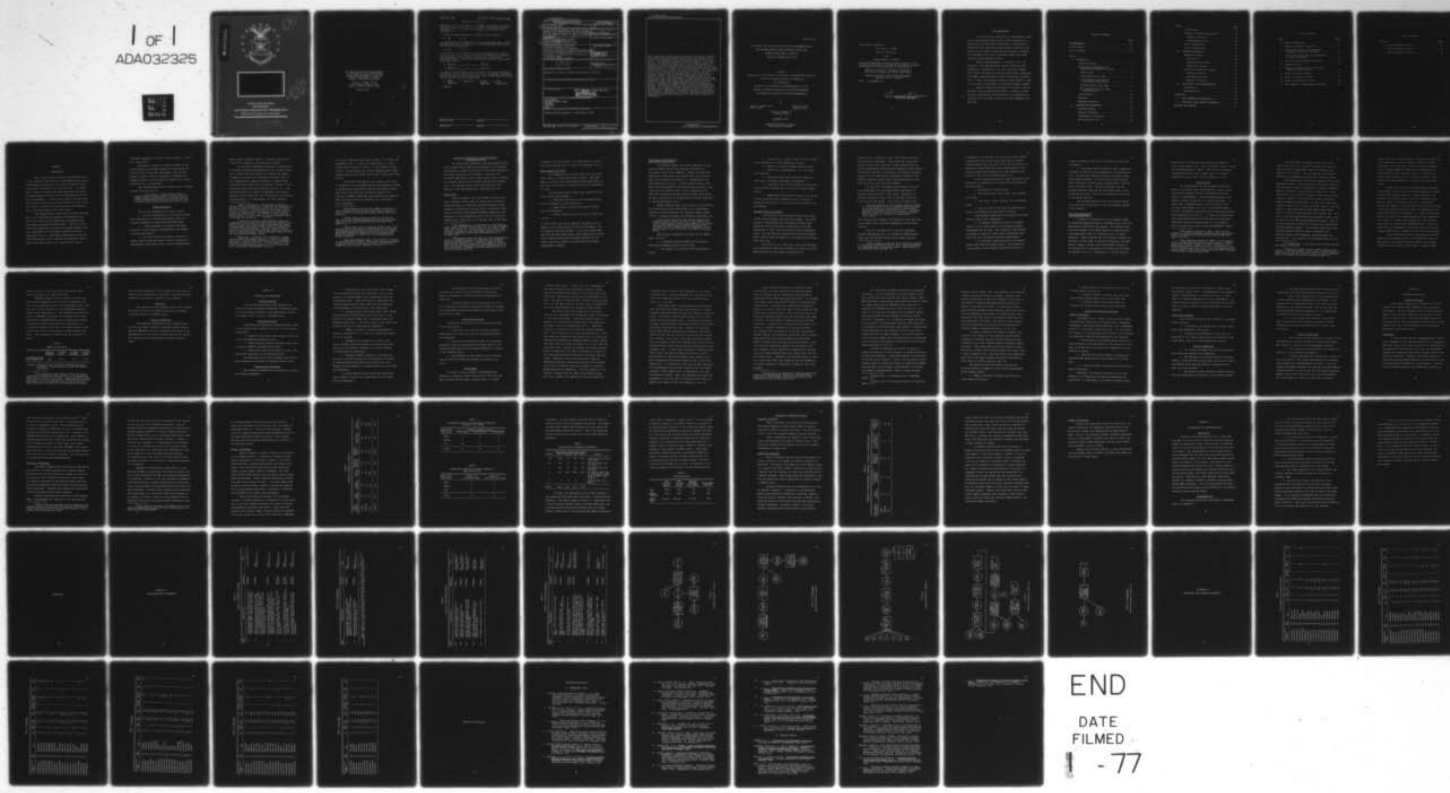

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UNITED STATES AIR FORCE

AIR UNIVERSITY

AIR FORCE INSTITUTE OF TECHNOLOGY

Wright-Patterson Air Force Base, Ohio

AN INQUIRY INTO THE POSSIBLE EFFECTS OF IMPLEMENTATION OF THE VARIABLE SAFETY LEVEL TECHNIQUE OF THE D041 SYSTEM ON WRM ITEMS IN TERMS OF NORS(G) INCIDENTS AND HOURS

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SLSR 25-76B

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(i.e. Not operationally Ready Supply -- Grounded)

This thesis deals with Air Force inventory policy for the efficient stockage of recoverable items within the context of the Recoverable Consumption Item Requirements Computation System (D041). The specific logistics problem addressed is the identification of a possible compromise in operational support (as measured by NORS(G) incidents and hours as reported by the D165A system Selected Items of Equipment Not Operationally Ready Supply Data System ~~(D165A))~~ as a result of the incorporation of the Variable Safety Level (VSL) concept into the D041 system. The implementation of the VSL technique was designed to provide optimal inventory support for recoverable items within the context of the D041 system. The results of this present research suggest the possibility that a certain number of operationally significant items exist which may degrade the intended objective due to the decreased support that these items would receive under VSL policy. Specifically, ~~these~~ WRM/WRSK items may generate an increase in NORS(G) incidents, requiring additional WRSK withdrawals. ~~As a result,~~ economic efficiency and peacetime effectiveness may be achieved at the possible expense of wartime effectiveness. Because of limitations imposed on this research (the present nonavailability of data), the thesis results are indicative rather than conclusive, and additional research is recommended.

War readiness spare kits

1473B

SLSR 25-76B

AN INQUIRY INTO THE POSSIBLE EFFECTS OF IMPLEMENTATION OF THE VARIABLE SAFETY LEVEL TECHNIQUE OF THE D041 SYSTEM ON WRM ITEMS IN TERMS OF NORS(G) INCIDENTS AND HOURS

A Thesis

Presented to the Faculty of the School of Systems and Logistics

of the Air Force Institute of Technology

Air University

In Partial Fulfillment of the Requirements for the

Degree of Master of Science in Logistics Management

and Master of Science in Facilities Management

By

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September 1976

This thesis, written by

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and

Captain Perry L. Sholer

has been accepted by the undersigned on behalf of the faculty of the School of Systems and Logistics in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE IN LOGISTICS MANAGEMENT
(Ms. Julia C. Denman and Captain John Gavel)

MASTER OF SCIENCE IN FACILITIES MANAGEMENT
(Captain Perry L. Sholer)

DATE: 7 September 1976

Eugene E. Jones
COMMITTEE CHAIRMAN

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CHAPTER I

INTRODUCTION

Much of the military success of our armed forces in past conflicts has been due to the emphasis the military establishment has placed on its ability to provide logistics support to strategic and tactical units. In recent years, logistics planning and performance has received an increasing degree of recognition and consideration by Air Force policymakers. In this regard, one of the most difficult logistics tasks faced by the Air Force is how to allocate dollars to provide the most efficient and effective use of available assets at any time (5:20).

This research effort deals with Air Force inventory policy for the efficient stockage of recoverable items within the context of the Recoverable Consumption Item Requirements Computation System (D041). D041 is an automated data system which reflects the average materiel support requirements for recoverable items for Air Force operations (17:1-1). Recoverable items--those items that when unserviceable can be repaired by maintenance activities at the base or depot, and reissued--are, from a

management standpoint, the most complex category of inventory items (5:22).

The specific logistics problem addressed is the identification of attendant problems of integrating the Variable Safety Level (VSL) requirement into the D041 system to protect against fluctuations in demands and unexpected delays in the resupply of assets due to repair, transportation, or procurement.

The Variable Safety Level technique uses a marginal analysis model to look at:

> . . . all items in a computational group i.e., budget programs, budget program activity code, and federal supply classification to determine within funding constraints the most efficient mix of items on hand and the optimum quantity per item [16:129].

Problem Statement

This thesis addresses the following issues:

1. Can the incorporation of the Variable Safety Level technique into the D041 data system result in a possible compromise of Operational Readiness (OR)?

2. Is the attainment of economic efficiency achieved by this technique accomplished at the expense of operational support?

3. Will the items which receive a decline in budget support under VSL cause an overall increase for operationally significant items in the Not Operationally

Ready Supply--Grounded (NORS(G))[1] commodity hours and/or incidents as reported by the D165A data system?[2]

The Air Force management objective in implementing the Variable Safety Level computation into the D041 system was to achieve the best safety level support per dollar invested in inventory by minimizing backorders[3] (17:1-1). Such implementation requires tradeoffs in support from high-repair-cost items with low inventory turnover to low-repair-cost items with high inventory turnover (4). The Variable Safety Level formula is designed to provide an increase in the safety level for items having the following characteristics: (1) high demand, (2) long leadtime,

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[1]NORS is defined as: "The aerospace vehicle or selected item of equipment not capable of performing any of the primary missions assigned to the unit due to lack of part(s) [19:1-3]." In the context of this thesis NORS is related to commodity hours as opposed to aircraft hours unless otherwise stated. "An aircraft will be reported NORS(G) when it is not capable of flight (grounded) due to a verified lack of parts . . . [19:2-17]."

[2]Historical records of NORS commodity hours and incidents are maintained and reported by the Standard Aerospace Vehicles and Selected Items of Equipment Not Operationally Ready Supply Data System (D165A) at Headquarters Air Force Logistics Command. This data system receives input of requisitioning items from the D165B data system at each Air Logistics Center. The D165B system receives input from the base level supply system.

[3]Backorder is defined as: "An obligation, assumed and recorded by any supply echelon, to issue at a subsequent date a requisitioned item which was not immediately available for supply [19:1-9]." In the context of this thesis the supply echelon referred to will be base level (i.e., a Due Out to Maintenance) (18:1-2).

(3) high Not Reparable This Station (NRTS),[4] (4) small unit procurement cost, (5) small unit repair cost, (6) small Budget Support Objective (BSO),[5] (7) high number of users (15:29). On any given item, varying combinations of these characteristics would affect the Variable Safety Level (VSL) formula.

The problem addressed by this research effort was to determine if the increased support theoretically afforded to operationally significant items by the Variable Safety Level mode of the D041 data system may result in an increase in NORS(G) conditions and a reduction in NORS(F)[6]/ NFE[7] conditions within the framework of a reduction in total backorders.

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[4]Not Reparable This Station (NRTS) is defined as: "The percentage of failed items which must be sent to a central repair activity having greater repair capability [18:1-1]."

[5]Budget Support Objective (BSO) is defined as: "The reduction in expected backorders resulting from the addition of one spare divided by the unit cost of the spare [2:9]."

[6]"An aircraft will be reported NORS(F) when it can be flown but is not capable of performing all of its command assigned missions due to one or more of its command designated systems or subsystems being inoperative and parts are required to return it to a fully operational status [19:2-17]."

[7]Not Fully Equipped (NFE): "The aircraft is capable of performing one or more of the primary missions assigned to the unit but has some limitations on its operational capability due to lack of part(s) [19:1-31]."

Recoverable Consumption Item Requirements Computation System

The Recoverable Consumption Item Requirements Computation System (D041) computes requirements for recoverable items subject to depot level repair,[8] with three exceptions. The exempt categories of contingency, insurance, and obsolete[9] items cannot, due to their nature, have a consumption related stock and are excluded from the D041 computation. The remaining active items constitute the vast majority of the USAF recoverable item inventory (16).

Buffer Stock

The D041 system, like other modern inventory systems, includes a buffer stock or safety level quantity to reduce the risk of a stock-out condition caused by unpredictable fluctuations in failure rates, insufficient lead-times, or a faster than expected inventory depletion rate. Although it is not immediately clear just how large this "safety stock" should be, it is apparent that as the stock

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[8]The Expendability, Recoverability, Repairability (ERRC) Codes included are XD1, XD2, XD3, and until November 1975, XF2 (18:1-5; 4). For purposes of this thesis, XF2 items are included in the stock number population--since the D041 computation cycle simulated uses data as of 31 March 1975.

[9]Contingency items are those for which Headquarters USAF has directed retention of quantities for which no program requirements exist. Insurance items are those which are not subject to periodic replacement or wearout. Stock levels are established by higher headquarters or by the item manager. Obsolete items are those for which no future use is planned (16).

increases to a certain level, the probability of an aircraft being grounded due to stock-outs decreases (18:1-2).

Fixed Safety Level Mode

The computation of a buffer stock level was originally based on a Fixed Safety Level concept. The depot safety (or stock) level consisted of thirty days stock for each item and was based on that item's rate of consumption (17:1-18).

The following three problems were inherent to the Fixed Safety Level concept:

1. There was no measure of effectiveness versus dollar investment on a per-item basis.

2. Depot repair time and procurement leadtime were not considered.

3. Dollar constraints did not play a direct role (15:5-8).

In other words, the cost of supplying the same level of support to all items varied but was not considered. Not all pipeline time was included. One of the biggest problems with the D041 Fixed Safety Level Computation was that even if safety levels were increased uniformly for all items, there was no means of determining the expected improvement in support.

Multi-Echelon Technique for Recoverable Item Control

The Variable Safety Level model addressed by this thesis evolved from the Multi-Echelon Technique for Recoverable Item Control (METRIC). METRIC, an analytical mathematical model which uses integer non-linear programming, was introduced in 1966 by C. C. Sherbrooke of the Rand Corporation (13:iii). It was translated into a computer algorithm capable of determining base and depot stock levels for recoverable items. A major purpose of this model was to determine optimal base and depot stock levels for each item, subject to a constraint on system investment or system performance (13:2).

METRIC computes stock levels based on the objective of "minimizing the sum of backorders on all recoverable items at all bases pertinent to a specific weapon system [13:6]." Sherbrooke defined the backorder minimization as:

> Take a fixed period of time and add together the number of days on which any unit of any item at any base is backordered; dividing this number by the length of the period and taking the expected value of the statistic, yields a number that is independent of the period length. This is the value we seek to minimize [13:6].

The following assumptions are made for the METRIC model (13:8-12):

1. A compound Poisson probability distribution describes the demand process for each item.

2. The demand is stationary over the prediction period.

3. The decision to repair a unit at base or depot level depends only on the complexity of repair.

4. There is no lateral resupply between bases.

5. There are no condemnations (i.e., all items are repaired).

6. The depot repair begins when the reparable base turn-in arrives at the depot (no batching).

7. Items and bases may have different essentialities but METRIC assumes that all items have equal essentiality.

8. Demand data from different bases can be pooled in some manner so that a composite initial estimate of demand per flying hour (or any other program element) can be obtained.

Variable Safety Level Mode

The transition from the Fixed Safety Level mode to the Variable Safety Level mode was gradual. The first studies of the possible use of marginal analysis techniques by the Air Force were accomplished by the RAND Corporation in 1962, and were tested at three operational bases. The test results indicated that the base stockage model could be used successfully in an operational environment (15:23-24).

From 1968 to 1970, additional tests involving depot level maintenance items were conducted at Robins Air Force Base and Kelly Air Force Base to determine the

practicability of computing depot stock levels using marginal analysis techniques. These tests met the program criteria established (14:23-24) (these criteria did not include operational considerations addressed in this thesis). The decision was made to incorporate the marginal analysis concept into the requirements computation process of the Advanced Logistics System (ALS) under development at that time in the Air Force Logistics Command.

In June 1974 a technique using marginal analysis was incorporated into the requirements computation of Economic Order Quantity[10] (EOQ) items. Department of Defense Instruction (DODI) 4140.39 provided the policy directive for this change. This directive states that:

> Thus the objective of this policy concisely stated is: To minimize the total of variable order and holding costs subject to a constraint on time-weighted essentiality-weighted requisitions short. The mathematical formula for the use of a shortage parameter which can be set to control the safety level . . . [Sic] [20:2].

The directive was intended to be applied to EOQ items, and to any other items (including reparables) to the extent feasible.

When the implementation of ALS was repeatedly delayed, Headquarters Air Force Logistics Command determined that the Variable Safety Level concept could be

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[10] EOQ or expense items are those which are procured or ordered in uniform size lots so as to minimize purchasing, transportation, and storage costs. They consist of two ERRC codes (XF3 and XB3) (4).

independently incorporated into the existing D041 system. A comparison test of D041 Fixed Safety Level and D041 Variable Safety Level for the FY 75-3, FY 75-4 and FY 76-1 computation cycles resulted in the incorporation of the Variable Safety Level technique into the operating D041 system for the FY 76-3 processing cycle (4).

In the Variable Safety Level mode, the safety level maintained is determined by analyzing the following item characteristics:

1. The demand or failure rates.

2. The depot repair, base repair, and condemnation rates.

3. The repair, order, shipment, and procurement times.

4. The unit cost of the item (to determine the return on investment for each item) (15:19-20).

The following constraints are imposed on the D041 Variable Safety Level computation:

1. No marginal analysis solution is accepted unless it is at least equal to the worldwide average requirement for the item. This constraint was designed to prevent a "negative" safety level requirement which would cut into the average pipeline requirements.

2. No marginal analysis solution is allowed to provide more than 99% support level. This constraint was provided to avoid spending additional dollars to

achieve an expected reduction in backorders of less than one percent.

3. The Budget Support Objective (BSO) concept was developed to allow for the consideration of available dollars. The BSOs were selected initially by weapon system within Budget Program. For those Federal Stock Classes (FSCs) which may be designated as problem FSCs, a new BSO may be assigned (3:22). The BSOs are input into the marginal analysis algorithm and the optimum spare levels associated with their values are determined for each item in the system (2:8-10).

The problems associated with the Variable Safety Level mode will be discussed in the Justification section of this thesis.

War Readiness Materiel (WRM) Considerations

A number of differences are noted between combat and peacetime demand-forecasting considerations in the D041 Requirements Computation Data System. The "steady-state" situation assumed in the METRIC method of computing inventory requirements does not necessarily hold in combat campaigns. These campaigns are of relatively limited time duration, are the target of specific planning or strategic decision making, and may cause considerable overload in the capacities for maintenance and overhaul in the combat environment (6:12-13). Consequently, a certain level of

operationally significant materiel must be stocked to insure surge capabilities. This requirement level is called War Readiness Materiel (WRM)[11]. WRM levels are computed separately from, and are an added input to, the basic computational cycle using the D041 system (17:1-25).

Justification

The justification for this research effort was based on the premise that the assumptions common to both the Fixed and Variable Safety Level modes of the D041 system are questionable. These assumptions equate backorders to NORS(G) conditions on a one-to-one basis. In other words, increased support could be given to noncritical items because all items are considered equally critical, increasing the possibility of compromising Operational Readiness (13; 18:1-2). In addition, these assumptions make predetermination of the degree of compromise impossible and produce uncertainty as to the possible effect on duration of stock outage and WRM/WRSK[12] support.

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[11]War Readiness Materiel (WRM): "That materiel required to augment peacetime assets to completely support forces, missions, and activities reflected in USAF war plans [19:1-46]."

[12]War Readiness Spares Kit (WRSK): "A kit consisting of selected spares and repair parts needed to sustain operations (without resupply) at base, deployed or dispersed locations for the first month of conventional activity in USAF war plans [19:1-46]." For the purposes of this research, Base Level Spares Sufficiency Kits were considered to be a form of prepositioned WRSK.

The D041 system in either a Fixed or Variable Safety Level mode is a "closed"[13] decision model and as such is prone to suboptimize either the system or subsystem(s) (21:196-197). This can best be illustrated by examining the assumptions on which both modes are based.

Both modes share the implicit assumption that every backorder results in the grounding of an aircraft (18:1-2). This assumption equates a backorder to a NORS(G) condition. Because a backorder is by definition insensitive to the application of the item,[14] the lack of that item may cause a NORS(G), NORS(F), or NFE condition, making the above stated assumption questionable. Of the three conditions, a NORS(G) condition is the most critical; however, the D041 system, in both Fixed and Variable Safety Level modes, fails to take this important fact into account (10). As a result, the Fixed Safety Level mode provides an equal level of support to all potential backorder conditions. This is clearly suboptimal in terms of the real world requirements of weapon systems support. The Variable Safety Level mode provides varying levels of support contingent upon marginal analysis using budgetary and operational constraints (15). As a result of the insensitivities of both

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[13]A closed model is one having only limited environment input (21:196-197).

[14]Within the context of this thesis items are considered to be base stocked. Since items stocked at depot for depot use only are not directly related to field operations, they do not impact the areas of study addressed (4).

modes, there is no rigorous method of determining what will be the tradeoffs in terms of NORS(G), NORS(F), and NFE conditions. In other words, there is no way to determine if the increased support theoretically afforded by the Variable Safety Level mode may result in a reduction in NORS(F)/NFE conditions and an increase in NORS(G) conditions within the framework of a reduction in total backorders.

Another ramification of the homogeneous treatment of backorders relates to the uncertainty inherent in repair cycle and procurement leadtimes. These leadtimes, and possibly item failure rates, can both be affected by and have an effect on stockage policy (9). Consequently, significant changes in stock levels due to the use of Fixed or Variable Safety levels may result in differences in the number and duration of backorders (9). Thus, the Variable Safety Level mode may produce numerically fewer backorders that result in a longer total stock-out or zero balance time (that is, greater NORS commodity hours). Since both factors are time dependent, the tendency would be for the aircraft NORS rate to increase and the OR rate to decrease.

A final ramification of the insensitivity of both modes is in the support given to the operating levels of WRM items (in the context of this research, the analysis of WRM items is limited to WRSK items). Support of WRM

levels, per se, is 100% under either mode since these levels are additive to operating levels.

WRM/WRSK items are most critical in wartime and, with certain exceptions, most critical in peacetime (11). One of the recognized faults of the Fixed Safety Level mode was that it often required the use of WRM/WRSK assets to support daily operations (8). The support given operating levels of WRM/WRSK items under the Variable Safety Level mode cannot be predetermined since no essentiality weighting has as yet been incorporated into the system (15). It should be noted at this point that these types of items also account for a high percentage of NORS incidents and hours. This statement is supported by the statistics in Table 1.

TABLE 1

IMPACT OF WRM ITEMS

	Number of WRM Items	% of Total Items	% of NORS Incidents	% of NORS Hours
All degrees of Base Repair Capability[15]	7889	21.5	70.3	47.9

(Sources: Inventory Data: D041 FY76-3 Computation Cycle.
NORS Data: D165A January-June 1975 NORS Reporting Period.)

[15]For purposes of this research effort an item is classified as having high base repair if it is repaired at base level 65 to 100% of the time. Items reparable at base level from 0 to 29% of the time are considered as having low base repair, and those reparable at base level from 30 to 64% of the time are defined as having medium base repair.

Based on these statistics, this category of items was considered to be operationally significant, and was therefore selected as the focus of concern in this research.

Objective

The objective of this research effort was to assess the impact of VSL on the number and duration of NORS(G) incidents relating to WRM/WRSK items.

Research Hypothesis

The hypothesis addressed by this research effort was that the number of NORS(G) incidents and the related hours for WRM/WRSK items may be adversely affected by the *implementation of the Variable Safety Level in the Recover*able Consumption Item Requirements Computation System (D041).

CHAPTER II

APPROACH AND METHODOLOGY

Universe Defined

The universe considered in this research was limited to those recoverable consumption items identified by the Recoverable Consumption Item Requirements Computation System (D041) as having a WRM/WRSK level.

Population Defined

The populations considered encompassed those items in the universe which complied with each of the following limitations:

1. Items for which source data existed relating to a given Requirements Computation Cycle.

2. Items which had existing traceable impact data in terms of NORS(G) incidents/actual hours.

3. Items which could be analyzed within the time constraints applicable to the research effort.

The population was further defined by the requirements computation mode used in computing safety levels.

Description of Variables

The following variables were considered in testing the research hypothesis:

1. Fixed Safety Level Stock Level--that integer value computed world-wide base stock level that is comprised of a standard demand level, negotiated level and Fixed Safety Level. Each stock level is associated with a Master National Stock Number (NSN) and its associated Interchangeable and Substitutable (I&S) subgroup(s).

2. Variable Safety Level Stock Level--that integer value computed world-wide base stock level that is comprised of a standard demand level, negotiated level and Variable Safety Level. Each stock level is associated with a Master NSN and its associated I&S subgroup(s).

3. NORS(G) Incident--a backorder representing a discrete transaction for a single item causing the grounding of an aircraft.

4. Maximum Critical Demand--an integer value nuance variable derived by adding the Fixed Safety Level Stock Level and NORS(G) Incidents for a Master NSN and its associated I&S subgroup(s).

5. Synthetic NORS(G) Incident--a non-negative, artificial variable created for this research and derived by subtracting Variable Safety Level Stock Level from Maximum Critical Demand for a Master NSN and its associated I&S subgroup(s).

6. Actual NORS(G) Hours--those hours associated with a NORS(G) Incident for a Master NSN and its associated I&S subgroup(s).

7. Average NORS(G) Hours--calculated to one decimal place by dividing the Actual NORS(G) Hours by the NORS(G) Incidents for a Master NSN and its associated I&S subgroup(s).

8. Synthetic NORS(G) Hours--calculated for use in this research by multiplying the Synthetic NORS(G) Incidents by Average NORS(G) Hours and rounding off the result to the nearest whole number.

Data Collection Plan

A data base was created from existing data by the following procedure:

1. Extracting data from the Air Force Logistics Command D041 and D165A data banks by establishing screening parameters.

2. Collating and summarizing data into meaningful parameters using existing Fixed and Variable Safety Level inventory models and analytical models developed in support of the research effort.

3. For purposes of this research, data collected from the D041 and D165A data systems was assumed to be valid.

Study Design

In order to trace, isolate, and determine the effects of a change in safety level policy, the first step was to analyze how the supply system reacts to a change

in safety level policy. Safety level is a component of the base inventory level; therefore, changes in safety levels are reflected as changes in the overall base inventory level. Two distinct issues must be addressed at this point; one issue is the fact that inventory levels are targets, and the other issue is the fact that the system does not react instantaneously to changes in these targets.

The first issue can be resolved by judiciously choosing the time period over which that impact is measured, in this case thirty days. Since the inventory level of concern is an authorized or target level some means must be found to relate the actual level to it. Base-level inventory is predicted on a thirty-day pipeline resupply time. This inventory level is the authorized level. Inventory depletion proceeds to the reorder point at which time resupply is incrementally requested based on actual demand. This means that the average inventory will be less than the authorized level. However, the amount of resupply received within a thirty-day time frame is designed to be equal to the difference between the authorized and actual inventory levels. Therefore, over a thirty-day time frame the authorized inventory, neglecting resupply, can be equated to the actual inventory level with resupply in terms of demand satisfaction capability. (For the purposes of this research, resupply over the impact data gathering time period was assumed to be immaterial since the authorized

inventory level was dealt with as opposed to the actual inventory level. Satisfied demands for a thirty-day time frame were therefore equated with the authorized stock level (1; 7; 12; 14).)

The second issue to be discussed arises from the fact that each D041 Computation Cycle results in a newly computed stock level which becomes the authorized inventory level. The actual inventory system takes time to adjust itself to this new target level. If assets are available at depot, this adjustment time would be within the standard thirty-day order and ship time. However, an increased level would require generation of additional serviceable assets and the time lag would be increased by the procurement leadtime. As a result, this time lag must be ascertained in order to equate the computed stock level with the authorized stock level and the matching steady-state actual inventory level. In the event a decrease in computed stock level occurs, the time lag equals the amount of time it would require to deplete the surplus level through issue. This time equals the surplus divided by the current daily demand rate. In either case, this time lag was compensated for by extracting from the D041 data bank the procurement leadtime or daily demand rate, as appropriate, for each I&S subgroup involved. Then, the computed stock level was transposed in time to match an authorized stock level and NORS(G) time frame for each I&S subgroup (7; 12; 14).

Having traced the impact of a change in safety level policy, the next step was to isolate the impact. NORS(G) incidents can be attributed to many different causes and can be terminated by various means. Of all NORS cause codes, only cause code H[16] reacts to stockage policy inelastically. By holding all other factors constant a change in inventory level will have a direct effect on NORS cause code H incidents/hours. Using a time adjusted point evaluation approach implies that for each additional asset available, one less NORS(G) incident would have existed. Conversely, a reduction in availability would result in an increase in NORS(G) incidents on a one-for-one basis. This assumes that the existence of critical unsatisfied demands (NORS(G)) is indicative of the fact that a significant proportion of satisfied demands would have been NORS(G) incidents had the asset not been available. Both logic and past experience support this assumption (14). This assumption can be additionally supported by the fact that the changes assessed dealt with safety level and not with demand level. Therefore, the absolute change in inventory levels would have been moderated, and the assumption of relative symmetry of character of demand is fully supportable.

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[16]Cause code H is defined as: "Less than full base stock--stock replenishment requisition exceeds UMMIPS (Uniform Military Movement Issue Priority System) time standards by priority group [19:2-19]."

The termination of NORS(G) incidents also warrants discussion. The four categories into which NORS(G) incident terminations may be placed are: depot resupply, WRM/WRSK withdrawal, cancellation, and alternative source. While the items under study are WRM/WRSK items, they are not authorized as WRM/WRSK stock at every installation. As a result it is incorrect to assume that all NORS(G) demands would be satisfied through WRM/WRSK withdrawal (Delete Code 7[17]). Therefore, it is necessary to assess the impact on Delete Code 1[18] because depot repaired items would not be available in the base-repair-cycle system. Cancellations can be neglected as they represent errors of one type or another and not true NORS incidents. Alternative sources such as lateral support and cannibalization are constrained; thus, any impact they absorb is system limited and as such can be neglected (7; 12; 14).

In order to determine the impact of changes in safety level policy, it was necessary to address the factor of unsatisfied demands. Unsatisfied demands are backorders to the base level customer. Since it was the focus of this research effort to stress the change in unsatisfied demands with the most critical impact, the parameters of concern were NORS(G) incidents/hours. Thus, a nuance variable,

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[17]Delete Code 7 is defined as use of WRM/WRSK assets (10).

[18]Delete Code 1 is defined as receipt of item from depot (10).

Maximum Critical Demand (MCD), was defined as the computed inventory level plus NORS(G) incidents. The MCD for an item was determined by adding the computed stock level to the NORS(G) incidents associated with that stock level during a thirty-day time frame. At this point the synthetic NORS(G) incidents were computed. Using source data from the appropriate time frame, a variable safety level computation was made using an operational model that had been empirically validated. The results of this computation were subtracted from the MCD and the non-negative synthetic NORS(G) incidents derived (1; 7; 12; 14).

In order to determine the impact of safety level changes on the duration of the above-delineated NORS(G) incidents, an average time per incident was derived and a synthetic total time computed based on synthetic NORS(G) incidents. Time accumulated under Delete Code 8T (cannibalization transfer) was treated as additive to Delete Code 1 (depot resupply) time. The justification for associating these times with depot resupply termination was based on past studies of delete code mean time (10).

The above-outlined study design provided the following factors in support of the analysis requirements of the research effort:

1. NORS(G) Incidents resulting from the use of Fixed Safety Level policy.

2. Actual NORS(G) Hours resulting from the use of Fixed Safety Level policy.

3. Synthetic NORS(G) Incidents that would have resulted had Variable Safety Level policy been used.

4. Synthetic NORS(G) Hours that would have resulted had Variable Safety Level policy been used.

Testing the Research Hypothesis

Numerical Analysis

The population of concern in this research effort was previously identified as including those recoverable consumption items which were determined to have a WRM/WRSK level for a given D041 computation cycle. For the following reasons, it was determined that a census of the delineated population would be more appropriate than sampling:

1. The majority of the system design and the computer processing time was devoted to the creation of a data base, an effort which would have been required for either sampling or census.

2. There was no a priori method of determining a representative sample prior to the creation of the data base.

3. A census provided a more precise and definitive basis for analysis.

Therefore, the following decision rule for supporting or not supporting the research hypothesis was quantified. An improvement or no change in support would

be indicated if the overall difference in NORS(G) incidents/hours (actual NORS(G) incidents/hours minus synthetic NORS(G) incidents/hours) is positive or zero. In this event the research hypothesis would not be supported. An adverse impact in support would be indicated if the overall change is negative and the research hypothesis would be supported.

Operational Analysis

The following objectives were defined for the operational analysis:

1. To determine the significance of change within Base Repair Capability (BRC) strata.

2. To assess the significance of the order of magnitude of the change resulting from the transition from Fixed Safety Level to Variable Safety Level policy.

List of Assumptions

1. The effect of resupply over the data-gathering time period was assumed to be immaterial.

2. The existence of critical unsatisfied demands (NORS(G)) indicated that a significant proportion of satisfied demands would have been NORS(G) incidents had the asset not been available.

3. The results of past studies of delete code mean time were applicable for purposes of this research effort.

4. The data obtained from the Air Force Logistics Command D041 and D165A data banks was assumed to be valid.

5. While the Variable Safety Level technique has not been operationally implemented at base level, it was assumed that the computed VSL stock level would be representative of the actual base stock level because the distribution system should be responsive to the assets made available by the D041 requirements system.

6. It was assumed that additional serviceable assets required would be procured as opposed to being obtained by increasing the productivity of repair cycle activities.

List of Limitations

1. The precision of the indication of impact of the implementation of the VSL technique on operational support was limited by the use of a point-assessment approach.

2. Use of partially-contrived data has reduced the precision of the indication of impact.

3. A severe limitation was encountered in terms of data availability. The oldest requirements data available only allowed for a thirteen-month time match. Since the average procurement leadtime for this data was approximately thirteen months, the use of this data was deemed acceptable. However, use of more recent data was deemed unacceptable due to the number of items that could not be analyzed.

CHAPTER III

FINDINGS AND ANALYSIS

Research Findings

This chapter presents the findings of the data research and relates these findings to the operational environment. The data analyzed from the D041 system was based on the 76-2 D041 Computation Cycle (asset cut-off date of 31 March 1975). The D165A ASB NORS master file data used was for the thirteen-month period from June 1975 through June 1976. The limitations to the processing methodology are described below.

Limitations

It was intended that the requirements data (D041) to be processed in this research would be for a computation cycle far enough in the past to allow for a time match with the appropriate NORS data for each item (the procurement leadtime for items contained within the D041 system varies from 4 to 24 months). However, three files required to replicate historical processing for any cycle prior to the 77-2 cycle were unavailable for this research. A search for an alternate source for the needed data resulted in

the location of duplicates of the missing files.[19] Duplicate historical files did not exist for operations prior to the 76-2 computation cycle. This processing cycle allowed an analysis of NORS data for only a thirteen-month period--from June 1975 through June 1976. A search of the WRM/WRSK items from the 76-2 computation cycle revealed a maximum potential fallout (items that could not be analyzed due to insufficient data) of 1928 items. This number represented only 20.4% of the total WRM/WRSK items identified; therefore, it was concluded that the research methodology would not be critically affected. The following section describes the processing methodology.

Processing Methodology

The CREATE (Computational Resources for Engineering And simulation Training, and Education) computer system, operated by the Air Force Logistics Command, was used for the extensive data collection required for this thesis. All programs developed for the research effort were validated using appropriate test data before initiating actual system processing. Numerous cross-checks were designed to insure the accuracy of the output products.

The data collection was divided into three phases. Phase I accomplished the isolation of the required data

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[19]These tapes were obtained from the Logistics and Concepts Division, Directorate of Logistics Plans and Programs, Deputy Chief of Staff Systems and Logistics, Headquarters, United States Air Force.

records from the D041 and D165A data bases and the formulation of this data for subsequent processing. Phase II involved making the necessary modifications to the existing FSL/VSL computer model[20] to initiate, compute and output the D041 Fixed Safety Level and Variable Safety Level stock levels for those records obtained in Phase I. Phase III included the following: (1) determination of the appropriate month for the NORS data search for each stock number in the population; (2) summarization of NORS data for each stock number for which the appropriate data existed; (3) computation of total actual and total synthetic NORS incidents and hours; (4) isolation of supporting statistics and information.

Appendix A contains three tables which list the programs included in each phase of the data collection and give a brief description of what each program was designed to accomplish. Figures 1-3 are also included in Appendix A. Each figure contains a system flowchart which relates the inputs to and outputs from each processing block within the phase described. Although single operations are indicated, the system design is illustrative rather than exhaustive. For example, in Phase I (Figure 1) the procedure shown is duplicated for each of the required NORS transaction tapes.

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[20]This model was designed, programmed, and is maintained by Management Sciences Division, Headquarters, Air Force Logistics Command/XRS.

The thirteen outputs from this process were merged to create one NORS master file which was input into Phase III processing (Figure 3). Also, for each process in Phases II and III, separate computations were performed for each of the three Base Repair Capability strata. The findings obtained from the processing methodology are presented in the following section.

Summary of Findings

Table 2 contains a numerical summary of the results of this research effort. A summary of findings of operational significance is contained in Table 3. For those items which had a computed Fixed Safety Level Stock Level (FSLSL) less than the Variable Safety Level Stock Level (VSLSL), supply support would be increased. For those items having an FSLSL greater than the VSLSL, supply support would be decreased. Table 4 presents operational information about this category of items. For those items listed as being zero-hour items, a NORS(G) incident was reported with no corresponding NORS hours, indicating a withdrawal from the WRSK kit to support the requirement.

Before continuing the analysis of the research findings, a further explanation is required as to the reduction in the stock number population as a result of screening parameters throughout the system. There were 9472 National Stock Numbers (NSNs) included within the framework of the D041 system (as of March 1975) which had a WRM/WRSK

TABLE 2

NUMERICAL SUMMARY OF RESULTS

Base Repair Capability	NSNs Analyzed	NORS(G) Incidents	NORS(G) Hours	Synthetic NORS(G) Incidents	Synthetic NORS(G) Hours	Incidents Difference	Hours Difference
High	25	94	75	232	127	-138	-52
Medium	19	63	770	113	971	-50	-201
Low	57	244	6823	140	3131	104	3692
Totals	101	401	7668	485	4229	-84	3439

TABLE 3

OPERATIONAL FACTORS BY BASE REPAIR CAPABILITY
AND LEVEL OF SUPPORT

Base Repair Capability	Number of NSNs Analyzed		
	FSLSL<VSLSL	FSLSL>VSLSL	FSLSL=VSLSL
High	3	11	11
Medium	7	3	9
Low	44	10	3
Total	54	24	23

TABLE 4

OPERATIONAL FACTORS FOR ITEMS COMPUTED TO
HAVE FSLSL>VSLSL

Base Repair Capability	Number of Zero-Hour Items	Number of Non-Zero Hour Items
High	10	1
Medium	1	2
Low	3	7
Total	14	10

requirement. Of this number, 592 items did not have the required system data for subsequent processing. The remaining 8880 stock numbers were divided into high, medium and low Base Repair Capability strata. Table 5 indicates the fallout throughout the system due to the stated screening parameters.

TABLE 5

FALLOUT DUE TO SCREENING PARAMETERS

	Base Repair Capability Strata				
Process	High	Medium	Low	Total	Reason
M6	1339	56	192	1587	Contingency or Insurance item
B1	200	39	36	275	No requirement for the item
I	480	85	240	805	No demand data for the item
L	1271	1558	3280	6109	No NORS(G) data and/or procurement leadtime greater than 13 months
M	1	1	1	3	Zero NORS(G) incidents
Total	3291	1739	3749	8779	

To relate the findings of the 101 NSNs analyzed to the population from which they were drawn, a data survey was conducted. The results appear in Table 6. Considering that a large variation normally exists in monthly NORS data, the 101 NSNs analyzed contrasted favorably with the average number of NSNs found in the delimited WRM NORS(G) population

(Cause Code H, Termination Codes 1 and 7), as do the number of NORS(G) incidents. The NORS(G) hours do not appear to be representative; however, it was noted that NORS(G) hours for the delimited WRM NORS(G) population ranged from 3609 to 67,187 during the thirteen-month time frame considered. Although the effect on NSNs that could not be analyzed is unknown, it is conjectured that these items were few in number, caused a relatively small number of incidents, and produced a large number of NORS(G) hours. Since these items were determined to have a procurement leadtime in excess of thirteen months, and were items to which VSL policy would have provided increased support, the above conjecture would appear to be valid. An analysis of the research findings is discussed in the following section.

TABLE 6

POPULATION DATA

	D041 (All Cond/ Causes)	WRM (All Cond/ Causes)	Delimited WRM/WRSK Stock Numbers	Stock Numbers Analyzed
NSNs	1777	282	119	101
NORS(G) Incidents	3131	2201	370	401
NORS(G) Hours	231,058	110,667	37,252	7668

Analysis of Research Findings

Numerical Analysis

Table 2 indicates that both the high and medium Base Repair Capability (BRC) strata showed an overall increase in NORS(G) incidents and hours. For the low BRC strata, hours and incidents showed an overall decrease.

Table 7 delineates the number of items within each strata which showed an increase in NORS(G) hours. This table also indicates the increase in hours and incidents represented by these items.

Operational Analysis

Table 2 indicates that by using the VSL model, an overall increase in the number of NORS(G) incidents was generated. Conversely, the number of overall NORS(G) hours was reduced from 7668 to 4229. Within the low BRC strata, a greater than 50% reduction in hours was indicated by the research findings. Those items which were contained in the high and medium BRC strata experienced an overall increase in NORS(G) hours.

The above findings must be considered from an overall systems viewpoint. A reduction in low BRC-strata NORS(G) hours should be considered a favorable impact of using VSL policy. However, the increase in NORS(G) incidents and hours for both medium and high BRC items must be further considered. As shown in Table 3, the items adversely affected by VSL policy tend to be zero-hour

TABLE 7

SUMMARY OF ITEMS SHOWING INCREASES IN NORS(G) INCIDENTS/HOURS

Base Repair Capability	NSNs Analyzed	No. Items with Increased Incidents	Resulting Change in Incidents	No. Items with Increased NORS(G) Hours	Resulting Change in Hours
High	25	11	142	1	77
Medium	19	3	70	2	452
Low	57	10	60	6	887

items (items for which an incident is reported with no corresponding hours) when they are within the high BRC strata, and non-zero-hour items (items for which an incident is reported with positive hours) when the items are within the low BRC strata. This observation indicates that high BRC NORS(G) incidents are normally terminated by WRSK withdrawal and conversely that low BRC incidents are terminated by depot shipment of assets.

It therefore follows that the net decrease in NORS(G) hours would tend to have a favorable impact on peacetime support of the flying mission. However, it must be noted that this reduction in NORS(G) hours is indicated to be at the expense of increasing NORS(G) incidents for items that are subject to termination by WRSK withdrawal. As a result, a potential adverse impact of VSL policy is suggested in that its application may necessitate the increased use of WRSK assets that are, by definition, required for wartime use in support of the flying mission. It should be noted that VSL policy indicated increased support for a greater number of items than for which it showed decreased support. However, the items that received additional support suggested the occurrence of more NORS(G) hours, while the items that received reduced support indicated more NORS(G) incidents.

Summary of Analysis

Based on the previously defined criteria rule, the research hypothesis was supported regarding NORS(G) incidents and no support was demonstrated regarding NORS(G) hours. That is, the synthetic NORS(G) incidents subtracted from the actual NORS(G) incidents was negative, while the synthetic NORS(G) hours subtracted from the actual NORS(G) hours produced a positive result.

Based on the previous analysis, it may be concluded that the adverse effect on NORS(G) incidents may impact the availability of WRSK assets.

CHAPTER IV

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Because of the continuing decline in funds made available to the Air Force to provide continued logistics support to operational units, there must be an increased effort to allocate this support in an efficient and effective manner. The implementation of the Variable Safety Level technique into the D041 data system was designed to provide optimal support for the recoverable items included within the context of that system. The results of this research suggest the possibility that a certain number of items exist which may degrade the intended objective due to the decreased support that these items would receive under VSL policy. Specifically, these WRM/WRSK items would generate an increase in NORS(G) incidents requiring additional WRSK withdrawals. As a result, economic efficiency and peacetime effectiveness may be achieved at the possible expense of wartime effectiveness.

Recommendations

The following operational and research recommendations are proposed:

1. An investigation should be made into the feasibility of making manual adjustments to VSL computed stock levels for high Base Repair Capability items that can be identified as NORS(G) problem items and which receive reduced support under VSL policy.

2. An investigation should be undertaken to determine the feasibility of developing within the framework of the D041 and D165A systems a reliable means of identifying (over a period of time) the recoverable items that consistently cause problems in terms of the occurrence of NORS incidents and/or hours.

3. An investigation should be made of the accuracy of production and administrative leadtime and other characteristic data as reported in the D041 system.

4. The items analyzed in this research effort and listed in Appendix B should be monitored as potential "problem" items.

5. As previously stated, the results of this research effort are indicative rather than conclusive because of the limitation of investigating only those items with a procurement leadtime less than or equal to thirteen months. It is therefore recommended that this research be replicated after NORS data becomes available through the month of May 1977. This would allow unrestricted implementation of the methodology designed for this research.

In order to overcome the limitation imposed on this research effort by the use of a point-assessment approach, it is recommended that subsequent efforts employ multiple-point assessments to determine the time sensitivity of the methodology developed for this thesis. Alternately stated, this research should be replicated using additional D041 computational cycles as data becomes available. Furthermore, it is recommended that the research effort be replicated to conclusively determine the actual impact of VSL policy on WRM/WRSK items when actual impact data becomes available to the extent that the use of partially-contrived data (Synthetic NORS(G) incidents/hours) would no longer be required.

APPENDICES

APPENDIX A

DATA PROCESSING INFORMATION

TABLE 8

PHASE I COMPUTER PROGRAMS

Name	Description	Language	Use
A	Inputs Depot Data Bank Master File Due-In Information (Type 13) to isolate those items which have a WRM/WRSK requirement.	FORTRAN	Create Master File
B	Determines potential fallout of items with procurement leadtime greater than 13. Attaches descriptive data to master file (obtained from Depot Data Bank Descriptive Data (Type 01)) and outputs information by BRC strata.	FORTRAN	Data Transformation
C	Inputs Depot Data Bank Usage, Past Program Data, and WRSK Master File and computes average demand for master stock numbers for subsequent processing.	FORTRAN	Data Transformation
D	Sorts all Depot Data Bank Files in Master Stock Number Sequence (not shown in Figure 1).	Utility and JCL	Data Transformation
E	Converts 13 D165A NORS monthly master. file tapes from IBM 7080 format to provide compatibility with CREATE.	Utility and JCL	Data Transformation
F	Sorts converted NORS transaction files in stock number sequence for subsequent processing.	Utility and JCL	Data Transformation

TABLE 8--Continued

Name	Description	Language	Use
G	Extracts NORS data contained within each month for only those stock numbers to be analyzed in this thesis.	FORTRAN	Data Delimitation
H	Merges NORS data from 13 delimited files to form NORS master file.	FORTRAN	Data Transformation

NOTE: Phase I, II and III Computer Programs have been stored on CREATE Library Tape Number 70294, File Name 2576B, and will be available through 10 August 1977.

TABLE 9

PHASE II COMPUTER PROGRAMS

Name	Description	Language	Use
M6	Extracts and merges D041 data by National Stock Number (NSN).	COBOL	Buy, simulation computations
B1	Computes D041 Requirements and Marginal Analysis inputs.	FORTRAN	Buy, simulation computations
BK	Assigns Key Corresponding to Budget Program System Management Code, and Federal Stock Class.	FORTRAN	Buy, simulation computations
S3	Makes Simulation Computation; outputs, by FSN, Large MA-D041 buys ($300,000 or more).	FORTRAN	Simulation computation
PI	Provides individual item printouts.	FORTRAN	Simulation computation

TABLE 10

PHASE III COMPUTER PROGRAMS

Name	Description	Language	Use
I	Takes output from S3 and adds demand data.	FORTRAN	Data Transformation
J	Takes merged output from I and adds base repair code and NORS month code.	FORTRAN	Data Transformation
K	Sorts the records by NORS month and by NSN within each month.	Utility and JCL	Data Transformation
L	Bypasses master records which require analysis of NORS data for months 14-24. Accumulates the appropriate NORS data for the remaining master records, computing NORS incidents and hours, and average NORS hours for each stock number.	FORTRAN	Data Delimitation and Computation
M	Computes MCD, total NORS incidents and hours, synthetic NORS incidents and hours and deletes those records containing zero NORS.	FORTRAN	Data Computation
N	Gathers data on number of NSNs, NORS incidents, and hours.	FORTRAN	Population Survey
O	Gathers data on 104 stock numbers isolated for analysis.	FORTRAN	Data Analysis

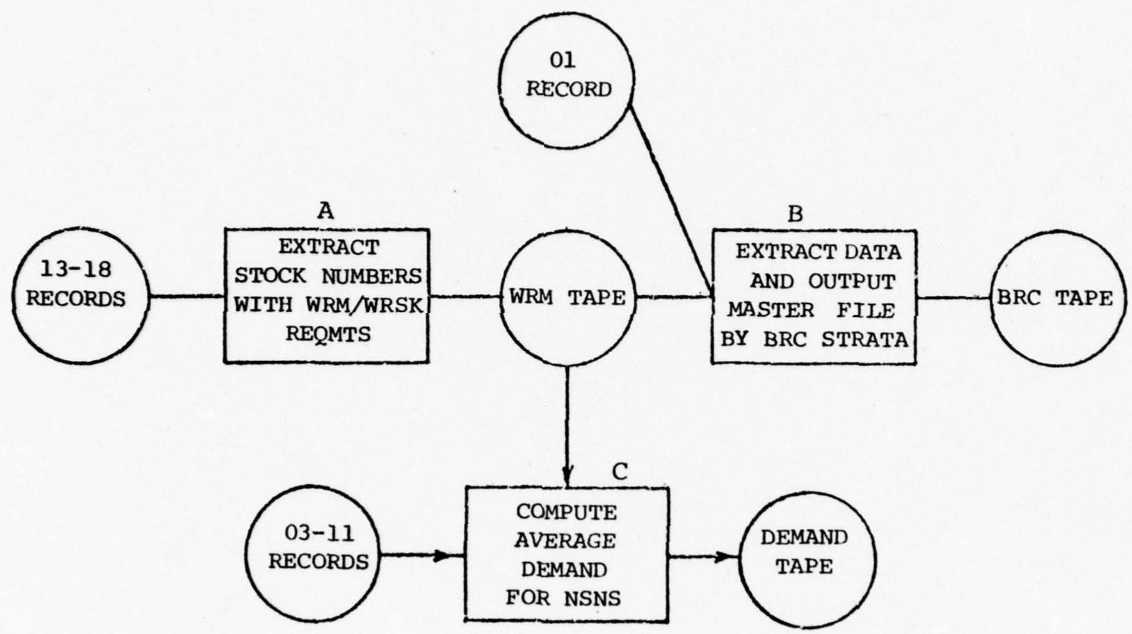

Figure 1

System Flowchart--Phase I

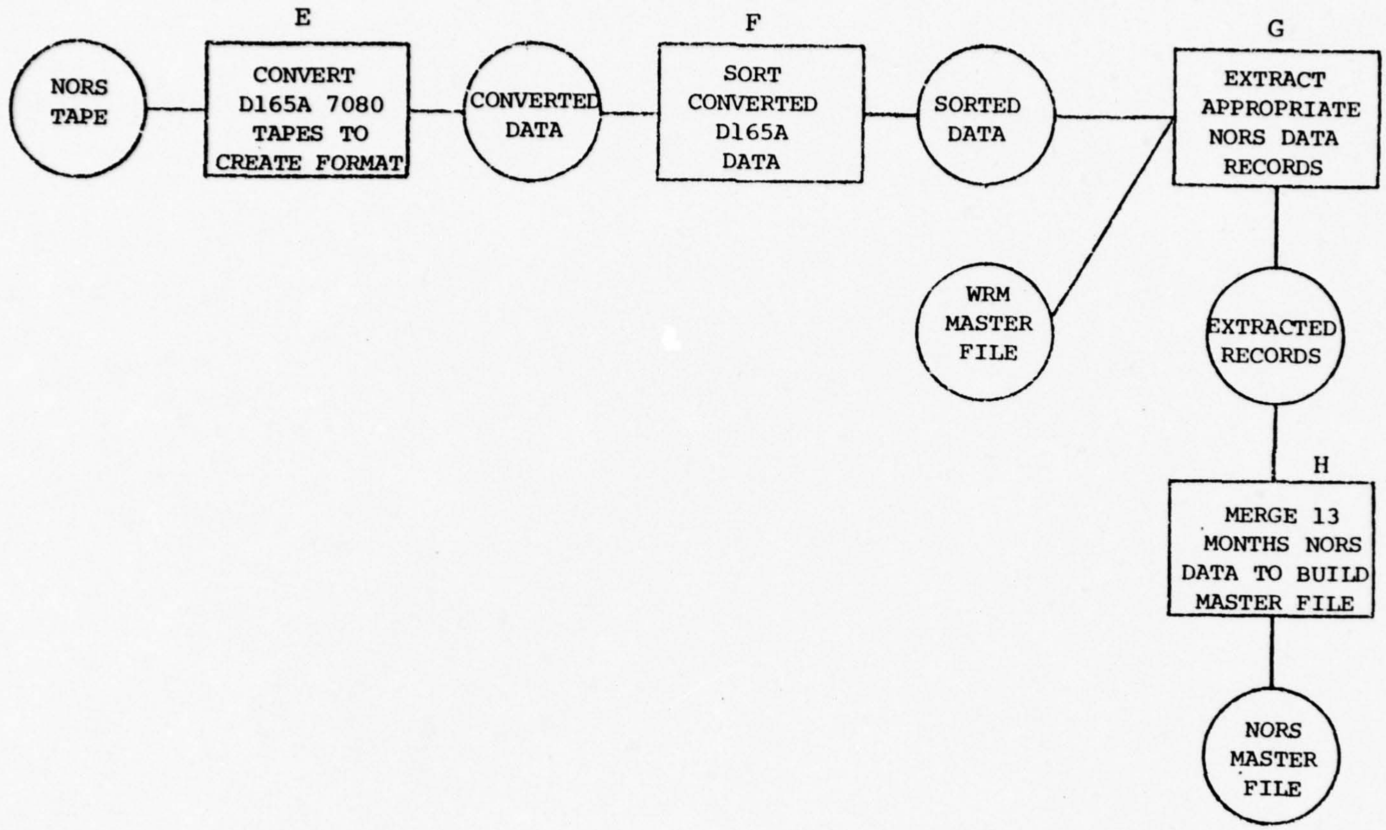

Figure 1--Continued

System Flowchart--Phase I

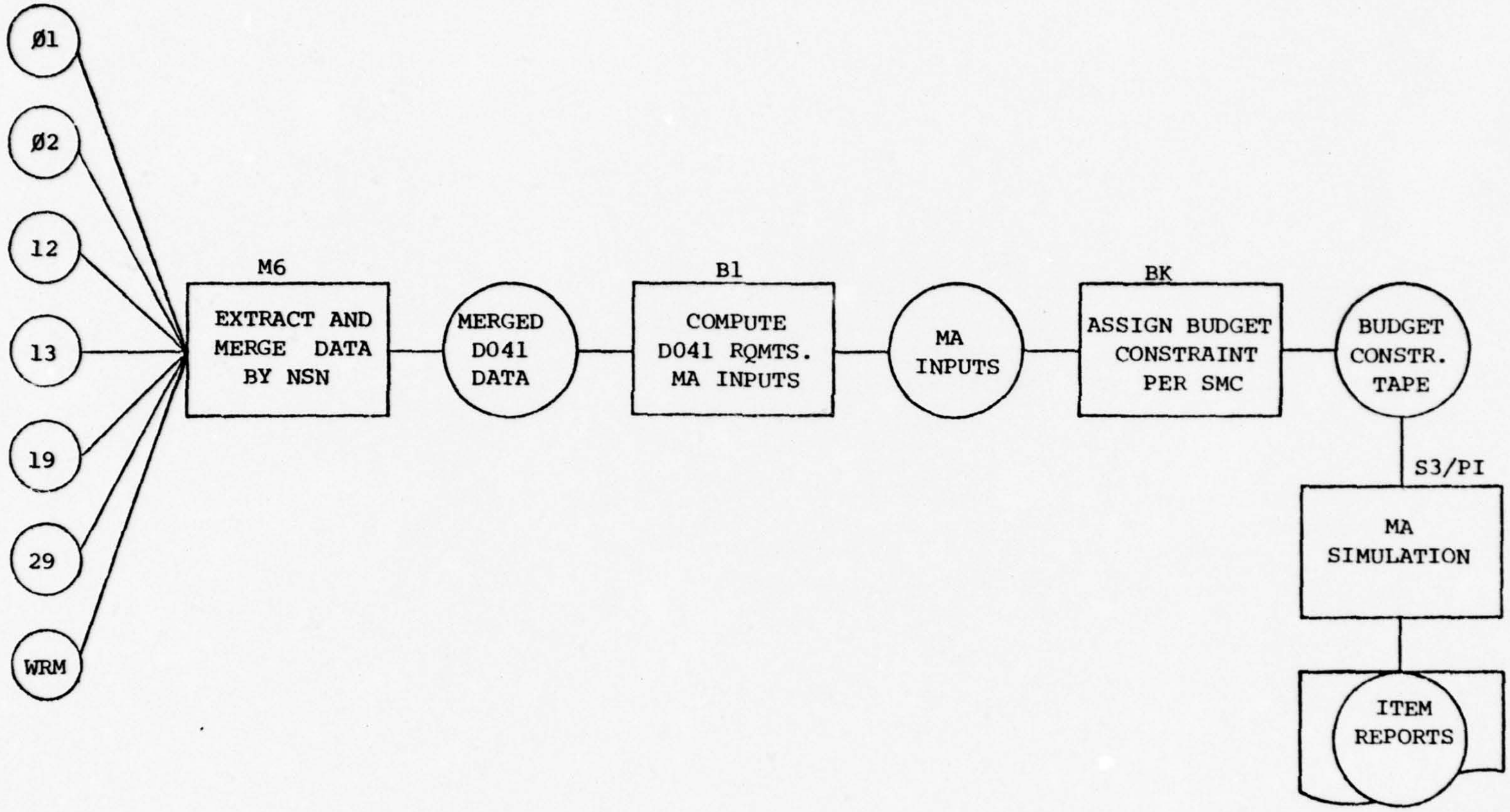

Figure 2

System Flowchart--Phase II

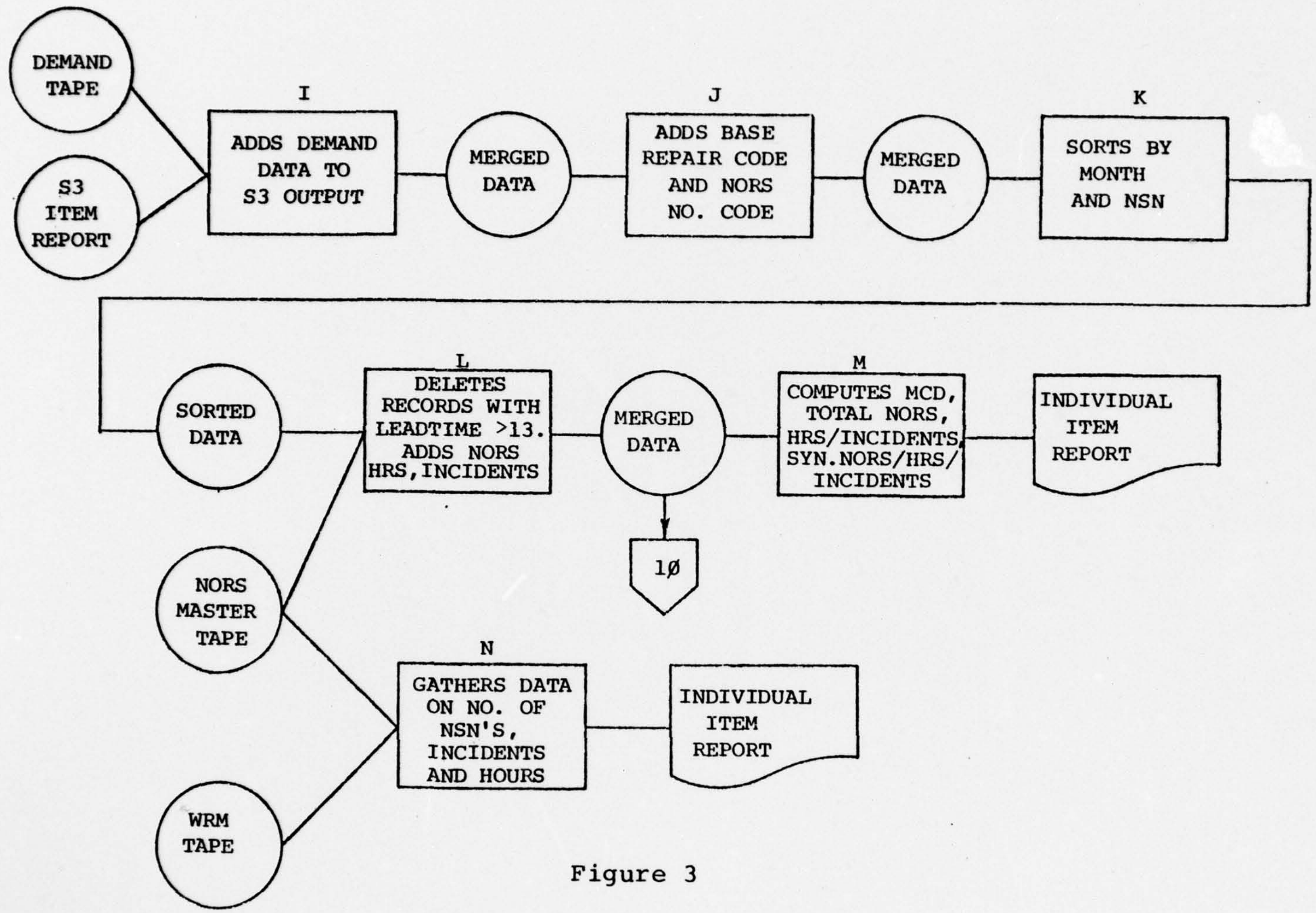

Figure 3

System Flowchart--Phase III

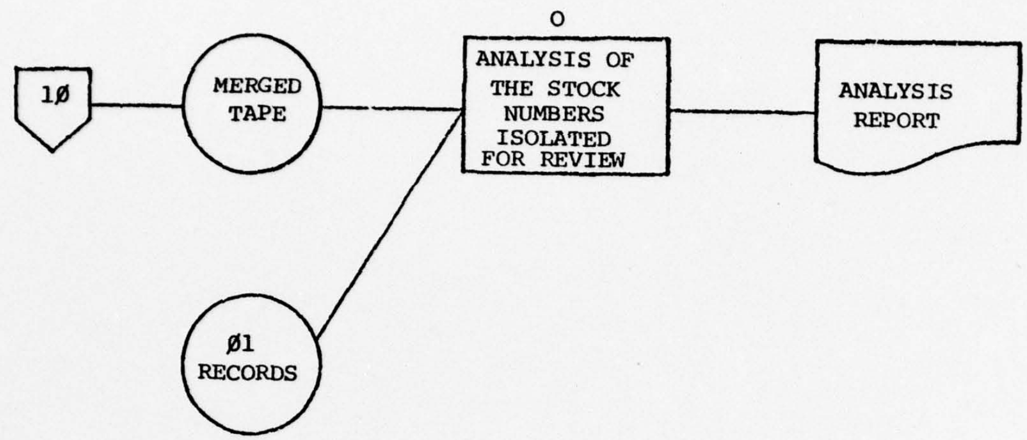

Figure 3--Continued

System Flowchart--Phase III

APPENDIX B

INDIVIDUAL ITEM SUMMARY INFORMATION

TABLE 11

DATA SUMMARY OF STOCK NUMBERS ANALYZED

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS (G) Incidents	NORS (G) Hours	Syn. Inc.	Syn. Hrs.
1005000180825	WR	CONT UNIT	23	13	76	86	1	0	0	0
1005000543185	WR	PALLET ASS	33	1	5	5	0	0	0	0
1005000726612	WR	POD SUU16A	97	1	21	21	0	0	0	0
1005007137872	WR	FEEDER	57	1	74	74	1	305	1	305
1095002692205BF	00	CL ADAPTER	0	1	0	0	0	0	0	0
1270000803613	WR	CONTROL	70	12	103	110	1	0	0	0
1270001185879	WR	CONVERTER	62	13	728	728	2	0	2	0
1270001813721	WR	INDICATOR	94	13	3577	3577	3	0	3	0
1270001814340	WR	ANTENNA	60	13	2251	2251	3	0	3	0
1270004512162	WR	DISPLAYOPT	39	13	172	172	2	0	2	0
1270004767946	WR	AMPLIFIER	91	13	2086	2086	7	0	7	0
1270005938904	WR	VALVE	29	12	578	590	3	0	0	0
1270007385406	WR	XMTRSASSY	25	12	1884	1905	4	179	0	0
1270008152999	WR	CONVERTER	75	12	16	18	1	0	0	0
1270009091639	WR	GYROSCOPE	21	13	274	281	2	0	0	0
1270009375051	WR	AMPLIFIER	76	13	654	654	2	0	2	0
1270009441958	WR	ARICONTROL	90	13	924	924	1	0	1	0
1270009842039	WR	MEMORYDRUM	89	13	729	729	2	0	2	0

TABLE 11--Continued

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS (G) Incidents	NORS (G) Hours	Syn. Inc.	Syn. Hrs.
1280004914282BJ	SM	PROGRAMMER	7	13	468	480	5	0	0	0
1280004983305	WR	MODULATOR	79	1	1389	1387	2	0	4	0
1280007571616	WR	COMPUTER	54	13	248	248	3	0	3	0
1280009216466	WR	MODULATOR	80	1	382	377	1	0	6	0
1280009338793NT	OC	COMPUTER	21	12	855	880	4	0	0	0
1430001341069BF	00	GYRO RATE	0	6	1080	1128	1	0	0	0
1430001390911BF	00	MSDGLRU 11	97	10	2961	2950	9	0	20	0
1430001803171BF	00	LRU16 N40R	79	4	6258	6233	6	0	31	0
1430001940606BJ	SM	CASSETTE	3	10	355	379	6	0	0	0
1430001946460BF	00	LRU19ECN40	81	4	13595	13560	7	0	42	0
1430004362362BF	00	RECVR TRAN	83	6	5750	5718	16	38	48	115
1430009183652BF	00	IND PILOTS	94	6	894	887	2	0	9	0
1440004835478AA	WR	LAUNCHER	5	12	1219	1230	2	176	0	0
1610000058685	WR	PUMPHSGASY	50	9	3880	3870	3	70	13	302
1610001029111	WR	GOVERNOR	12	12	348	359	1	128	0	0
1610005668131	WR	STABILIZER	8	12	1087	1146	4	0	0	0
1610006758041	WR	NOSE ASSY	10	12	486	509	3	316	0	0
1610007095413	WR	REGULATOR	25	13	1576	1578	17	409	15	361
1610007688173	WR	RESERVOIR	12	12	461	506	2	25	0	0

TABLE 11--Continued

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS (G) Incidents	NORS (G) Hours	Syn. Inc.	Syn. Hrs.
1610008844339	WR	HOUSING AY	46	9	5165	5145	12	132	32	352
1615000613067BZ	WR	MAIN BLADE	4	1	572	572	9	358	9	358
1615001523482GA	WR	BLADE ASSY	18	1	61	59	1	139	3	417
1615002552895GA	WR	TRANS ASSY	9	1	89	87	1	206	3	618
1615004680566BZ	WR	MAINGEARBX	19	11	111	112	1	0	0	0
1615009157142TH	WR	CLUTCH APP	26	1	1147	1147	1	24	1	24
1630001338184	00	WIRINGCARD	6	10	531	570	1	0	0	0
1630003941616	00	VALVE	71	12	29	37	1	25	0	0
1630004100858MA	OC	BRAKE ASSY	17	1	1316	1315	7	377	8	431
1630004534893	00	WHEEL MLG	81	1	22376	22366	2	0	12	0
1630006825326	00	CONTRL BOX	5	12	1212	1199	7	0	20	0
1630008795973	00	WHEEL MLG	47	1	1197	1197	1	0	1	0
1630009475100	00	CONTROL BX	37	1	1744	1744	1	0	1	0
1660000215554	OC	VALVE REG	6	10	754	760	3	0	0	0
1660000557092	OC	TURBINE	4	10	174	179	1	5	0	0
1660004591613MA	OC	VALVE	11	1	92	90	4	283	6	424
1660004907426	OC	CONTROLBOX	15	1	354	352	1	1	3	3
1660005405306	OC	CONVERTER	15	10	928	994	1	162	0	0
1660009069308	OC	CONTROLBOX	9	10	1715	1782	4	0	0	0

TABLE 11--Continued

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS(G) Incidents	NORS(G) Hours	Syn. Inc.	Syn. Hrs.
1660009376931	OC	TURBINE	24	1	570	567	7	227	10	324
2620007528651	00	TIRE MLG	20	6	493	514	4	0	0	0
2620008346673	00	TIRE NLG	2	1	4261	4235	1	0	27	0
2810009326249PA	SA	CYLINDER	5	11	465	495	8	477	0	0
2935001599040	OC	COOLER ASY	5	8	1866	1953	4	0	0	0
2935005801161	OC	COOLERASSY	17	9	779	802	1	8	0	0
4810001164493HS	OC	VALVE	14	11	466	492	6	314	0	0
4810005550700TP	OC	VALVE	6	11	455	488	3	198	0	0
4810006847650TP	OC	VALVE ASSY	19	11	91	94	1	240	0	0
4810008180440HS	OC	VALVE	51	11	1277	1355	2	0	0	0
4810008211391TP	OC	VALVE	41	11	488	511	5	159	0	0
4810008374812TP	OC	VALVE	8	11	324	353	1	0	0	0
4810009429348TP	OC	VALVE	11	11	2808	2960	1	73	0	0
4920004122751	SA	OSCILLOSCO	60	13	717	717	8	12	8	12
4920004265486	SA	MULTI ADAPT	85	13	320	320	1	0	1	0
4920004896504	SA	ADAPTER CM	77	13	956	956	5	12	5	12
5826008975519	WR	RECEIVER	87	5	10143	10131	1	0	13	0
5831007825305CW	WR	INTERCOMM	86	9	1987	2001	2	0	0	0
6340001165963BF	00	CONTROL	11	6	1723	1849	7	5	0	0

TABLE 11--Continued

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS(G) Incidents	NORS(G) Hours	Syn. Inc.	Syn. Hrs.
6340001199434	SA	COMPARATOR	79	1	448	448	1	0	1	0
6340008117801	SA	CONTROL	28	6	147	165	2	215	0	0
6615000867350	OC	AMPLIFIER	68	9	4906	4866	3	0	43	0
6615001320211LH	SA	CMPTR YAW	87	1	1061	1061	2	0	2	0
6615001320212LH	SA	CMPTR PAUG	75	1	445	445	1	0	1	0
6615001345226LH	SA	PITCH-PACS	89	1	1594	1594	2	0	2	0
6615002795865LH	SA	TEST MOD	15	8	268	274	1	0	0	0
6615003045014	OC	MOTOR / DR	20	1	192	184	1	0	9	0
6615003158625	OC	CONTROLLER	35	12	1072	1117	1	0	0	0
6615004026609LH	SA	SERVO ASSY	26	1	112	111	2	88	3	132
6615004479683	OC	GYRO DIREC	19	1	6710	6710	22	7	22	6
6615004995940LH	SA	GYRO AHRS	39	1	1601	1601	4	0	4	0
6615004995941LH	SA	COUPLER EL	91	1	1878	1876	16	0	18	0
6615005269441	OC	CONTROL	10	12	610	679	2	0	0	0
6615005350155	OC	MOTOR / DR	41	12	4640	4674	1	0	0	0
6615005506628	OC	GYROSCOPE	7	12	25128	25471	19	1250	0	0
6615005677949	OC	GYRO 2152L	11	12	401	414	5	95	0	0
6615005815792	OC	CONTROL J4	12	9	3920	4037	4	167	0	0
6615006001028BF	00	AMPLIFIER	9	9	936	1008	2	0	0	0

TABLE 11--Continued

National Stock Number	ALC Code	Noun	% BRC	NORS Code	FSL Level	VSL Level	NORS(G) Incidents	NORS(G) Hours	Syn. Inc.	Syn. Hrs.
6615006172878BJ	SM	GYRO ASSY	91	1	501	500	1	0	2	0
6615006186194	OC	GYROSCOPE	12	12	289	310	4	140	0	0
6615006731261	OC	COUPLER	44	12	3022	3049	8	0	0	0
6615007635228	OC	GYRO RATE	13	12	2041	2059	2	3	0	0
6615007635231	OC	GYRO RATE	16	12	2694	2712	14	345	0	0
6615007961466BF	OO	GYRO RATE	14	11	1754	1781	6	49	0	0
6615007961467BF	00	GYRO RATE	13	11	845	864	2	0	0	0
6615008367399	OC	GYRO 7000H	11	12	4295	4379	13	67	0	0
6615008775925MA	OC	ACELROMETE	0	8	200	201	2	67	1	33
6615009825301	OC	AMPLR3311K	55	12	1546	1553	2	92	0	0

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